INFORMATION ON THE USE OF HOME WATER TREATMENT DEVICES

Environment Ontario
Jim Bradley, Minister

The development of these guidelines was prompted by concerns over the integrity of advertising and promotional claims in respect of the treatment or removal of health-related contaminants in drinking water through the use of home water treatment devices. Advertising claims should conform with the *Voluntary Water Quality Industry Product Promotion Guidelines* of the Canadian Water Quality Association.

These guidelines are intended to provide information on such devices for the use of consumers, government agencies, manufacturers, sellers and others.

A municipal water supply requires no additional treatment at the tap for health-related contaminants. Municipal water has been treated to meet the standards for quality and purity of the Ontario Drinking Water Objectives.

These guidelines were prepared by an Ad-hoc Committee on Home Water Treatment Devices, comprised of the following Members:

Mr. George Missingham, Drinking Water Section
Water Resources Branch
Ontario Ministry of the Environment

Mr. David Radford, Consumer Advisory Branch
Ontario Ministry of Consumer and Commercial Relations

Dr. Ken Roberts, Manager, Drinking Water Section
Water Resources Branch
Ontario Ministry of the Environment

Mr. Duncan Smith, Environmental and Chemical Engineering Division
Ontario Research Foundation

Mr. Lou Smith, Executive Director
The Canadian Water Quality Association

Dr. Richard Tobin, Environmental Health Directorate
Health Protection Branch
Health and Welfare Canada

Mr. B. L. Miranda, Chairman, Drinking Water Section
Water Resources Branch
Ontario Ministry of the Environment

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DISINFECTION

These guidelines were developed specifically to cover the aspects of disinfecting water; municipal supplies already meet microbiological requirements for drinking water. Other chemical, physical and radiological constituents are discussed where appropriate.

- All household water treatment devices for use on raw water supplies should produce water that meets the requirements of the current *Ontario Drinking Water Objectives* and the *Guidelines for Canadian Drinking Water Quality.*
- Promotional claims for the removal of chloroform, pesticides, herbicides and similar organic material should be backed by adequate test data.

Certain conditions may prevent the satisfactory treatment of a raw water source by these devices alone. Different raw water quality requires a case by case review of a combination of treatment processes to produce water of drinking quality.

The following situations require careful consideration:

(a) Excessive bacterial population

It is recommended that raw water should not contain greater than 1,000 total coliforms per 100mL, or greater than 100 faecal coliforms per 100mL.

(b) The known presence of human pathogenic viruses

Raw water within the above limits for coliform levels would normally not be expected to present a virus problem; but when human pathogenic viruses are present, certain devices should not be used.

(c) Presence of protozoan parasites

Protozoan parasites such as the *Giardia lamblia* and *Entamoeba hystolitica* require the use of a filter with a pore size equal to, or less than, 5 micrometres.

(d) Excessive colour, turbidity, iron or organic impurities

Appropriate devices for aesthetic or chemical treatment may be required to address any of the above factors. It is important that subsequent bacterial analyses of the treated water be made with sufficient frequency to demonstrate the efficacy of the device in use.

(e) Storage recommendation

Treated water, by any process, should not be stored indefinitely. It is preferable to keep treated water under refrigeration, but not for more than two days.

1. Ceramic Filters

A. To be effective, operation should satisfy the following:

(1) Filtration devices impregnated with silver should not release silver or any other chemicals in amounts that exceed the Guidelines or Objectives mentioned above.

(2) Evidence should be furnished to demonstrate that each model/type has the potential to operate effectively over its lifetime.

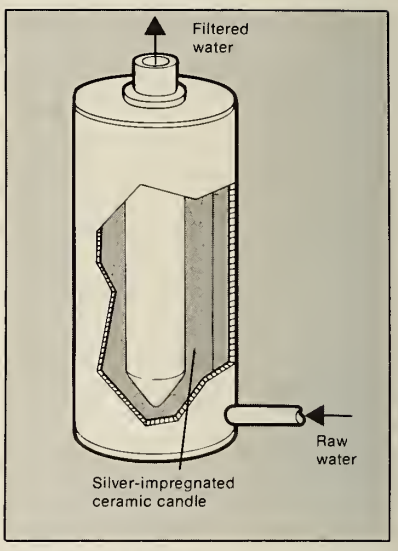
B. Limitations

(1) In order to ensure the proper functioning of the equipment, consumers should be made aware that care is required when handling, transporting, installing and cleaning a filter unit. A cracked or otherwise damaged filter may be rendered ineffective.

(2) Certain conditions may make treatment of a raw water source by filtration alone impractical. The following raw water quality characteristics should be carefully investigated when considering using a ceramic filter:

- **a.** Bacterial levels should not be excessive. As a guideline, raw water should not contain greater than 1,000 total coliforms per 100mL, or greater than 100 faecal coliforms per 100mL.
- **b.** Raw water in which human pathogenic viruses are known to be present should not be treated by this process. Raw water which meets the guideline for coliform levels would normally not be expected to present a virus problem.
- **c.** Ceramic filters do not provide complete protection against the build-up of micro-organisms in the distribution system. Initially and after a period of non-use, disinfection of the plumbing system downstream of the filter is recommended prior to putting it into operation.

  Note: This procedure is not required for counter-top or under the sink line by-pass units.



A silver-impregnated ceramic filter cartridge

2. Ultra-Violet Irradiation

A. To be effective, operation should satisfy the following:

(1) The unit must provide a minimum dose of 16,000 microwatt/second/cm^2 at a wavelength of 253.7 nanometres (nm) at maximum flow.

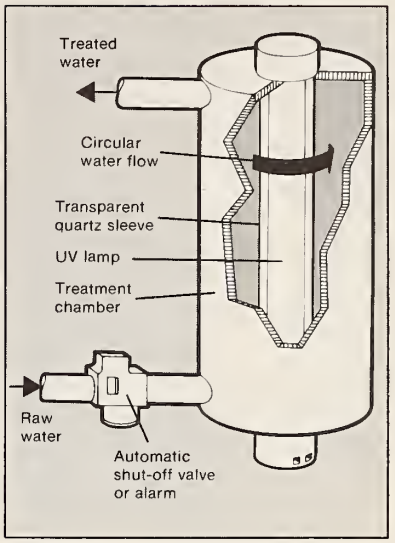
(2) The unit should incorporate a device for monitoring or sensing ultra-violet transmission through the maximum depth of water in the chamber, effective to meet the microbiological criteria in the above-noted guidelines or objectives. The monitoring or sensing device shall be designed to trigger an alarm in the event of lamp or sensor failure, or if insufficient ultra-violet light reaches the sensor.

(3) The unit should have an automatic flow control device, accurate within the expected range of operating pressures, so that the maximum design flow rate of the unit is not exceeded.

(4) The device should be designed to permit frequent mechanical or chemical cleaning of the water-contact surface of the jacket or lamp, without impairing the potability of the water.

(5) The materials of construction should not react with water, nor impart toxic constituents to it as a result of physical or chemical changes caused by exposure to ultra-violet energy.

(6) The unit shall be designed to protect the operator against electrical shock or excessive ultra-violet energy.



A typical UV irradiation device

B. Limitations

The raw water to the unit should be of satisfactory quality to ensure adequate treatment. The following raw water constituents may render the unit ineffective:

(1) **Excessive bacterial population**
Raw water containing greater than 1,000 total coliforms per 100mL, or greater than 100 faecal coliforms per 100mL, should not be treated by this device.

(2) **Presence of protozoan parasites**
Protozoan parasites such as *Giardia lamblia* and *Entamoeba hystolitica* may require the use of a filter with a pore size equal to, or less than, 5 micrometres.

(3) **Excessive colour, turbidity, iron or organic impurities**
Appropriate auxiliary equipment may be needed to address any of the above factors. Bacterial analyses of the treated water should be made with sufficient frequency to demonstrate the efficacy of the device in use.

Some of the above problems may be corrected by pre-filtration while the others may require specific pre-treatment, possibly more complex and expensive.

Ultra-violet irradiation will work best when voltage or cycle variations do not exceed manufacturers' specifications.

Since ultra-violet treatment does not provide residual bactericidal action, disinfection of the distribution system is recommended after any period of non-use.

The device should be cleaned regularly.

The output of an ultra-violet device decreases with age, so the lamp should be changed periodically, as required.

3. Iodination

A. To be effective, operation should satisfy the following:

(1) The iodinator should be capable of providing a dosage of iodine that will produce a continuous iodine residual of between 0.5 and 1.0mg/L following a contact time of

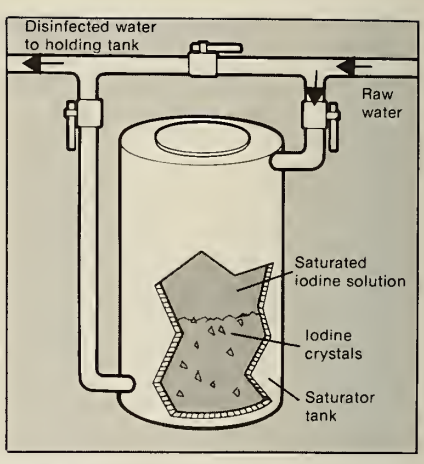
15 minutes for well waters
30 minutes for surface waters

A retention tank, in addition to a conventional pressure tank, may be required to achieve proper contact time.

(2) The materials of construction for both iodinators and contact systems should not react with water or with iodine, nor impart toxic constituents to treated water.

(3) If a saturator is used, the unit should be so designed as to permit an easy means of checking the level of iodine crystals. If other types of iodine releasing devices are used, frequent measurement of the iodine residual is required.

(4) An iodine residual test kit with a range of 0.5 to 1.0mg/L should be available for the user to carry out periodic tests for the desired residual levels.



Typical (saturator type) iodine feeder

B. Limitations

(1) The raw water to the unit should be of satisfactory quality to ensure adequate treatment. Raw water with the following constituents may require careful consideration prior to the use of iodine:

a. **Excessive bacterial population**
Raw water containing greater than 1,000 total coliforms per 100mL, or greater than 100 faecal coliforms per 100mL, should not be treated by this device.

b. **Presence of protozoan parasites**
Protozoan parasites such as *Giardia lamblia* and *Entamoeba hystolitica* require the use of a filter with a pore size equal to, or less than, 5 micrometres.

c. **Excessive colour, turbidity, iron or organic impurities**
Appropriate auxiliary equipment may be needed to address any of the above factors. Bacterial analyses of the treated water should be made with sufficient frequency to demonstrate the efficacy of the device in use. Some of the above problems may be corrected by pre-filtration while others may require specific pre-treatment, possibly more complex and expensive.

(2) Because the rate of disinfection may be slower at low temperatures, a contact time of 30 minutes is required, particularly in near-freezing water.

(3) An appropriate activated carbon filter positioned after the iodinator's retention tank may be advisable when used year-round because of possible adverse physiological effects of iodine on certain individuals.

Note: A tap should be installed **before** the filter to permit testing for the proper iodine residual levels.

4. Chlorination

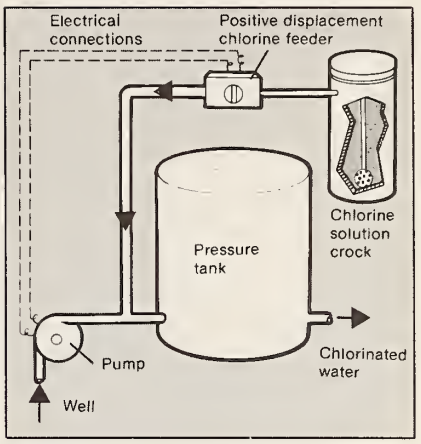
A. To be effective, operation should satisfy the following:

(1) The device should be capable of providing a dose which will produce a free available chlorine residual of at least 0.5mg/L following a contact time of at least 20 minutes. Other dose/time combinations may be used to achieve at least ct = 10 (where c = concentration of free-available chlorine residual, and t = time in minutes).

A retention tank may be required in addition to a conventional pressure tank to achieve proper contact time.

(2) The materials of construction for both chlorinators and contact systems should not react with water or with chlorine, nor impart toxic constituents to treated water.

(3) A chlorine residual test kit capable of detecting free-available chlorine (F.A.C.) with a range of 0.1 to 1.5mg/L should be available for the user to periodically test for the desired residual level.



A typical hypochlorination system

B. Limitations

(1) The raw water to the unit should be of satisfactory quality to ensure adequate treatment. Raw water with the following constituents may require careful consideration prior to the use of chlorine:

- a. **Excessive bacterial population**
  Raw water containing greater than 1,000 total coliforms per 100mL, or greater than 100 faecal coliforms per 100mL, should not be treated by this device.
- b. **Presence of protozoan parasites**
  Protozoan parasites such as *Giardia lamblia* and *Entamoeba hystolitica* require the use of a filter with a pore size equal to, or less than, 5 micrometres.
- c. **Excessive colour, turbidity, iron or organic impurities**
  Appropriate auxiliary equipment may be needed to address any of the above factors. Bacterial analyses of the treated water should be made with sufficient frequency to demonstrate the efficacy of the device in use.

(2) Excessive dissolved iron, manganese or some organics may precipitate, thereby requiring post-filtration treatment.

Note: If an activated carbon filter is used, a tap should be installed **before** the filter to permit testing for the proper chlorine residual levels.

5. Ozonation

A. To be effective, operation should satisfy the following:

(1) The device should provide a measurable amount of free residual ozone to the treated water immediately after treatment. An ozone specific test kit for residuals in the range of 0.1 to 1.5mg/L ozone should be provided with the unit, to enable the user to periodically test for the desired residual levels.

(2) Excess unused ozone from the treatment compartment should not be released to the immediate environment.

(3) The materials of construction for ozonators and contact systems should not react with water, ozone or ozonated water, nor impart toxic constituents to the treated water.

(4) The device should be constructed in such a manner as to avoid any electrical hazards to the user.

B. Limitations

(1) The raw water to the unit should be of satisfactory quality to ensure adequate treatment. The following raw water constituents may render the unit less effective and require careful consideration prior to the use of ozone:

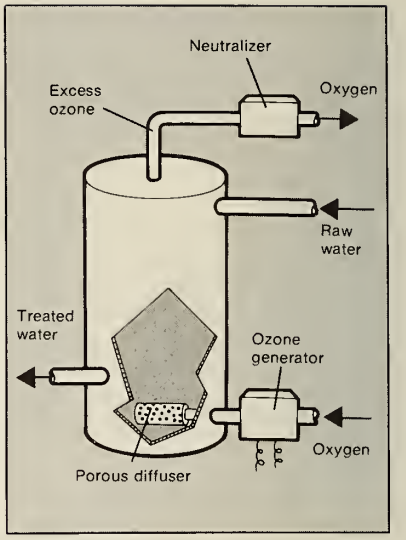
a. **Excessive bacterial population**
Raw water containing greater than 1,000 total coliforms per 100mL, or greater than 100 faecal coliforms per 100mL, should not be treated by this device.

b. **Presence of protozoan parasites**
Protozoan parasites such as *Giardia lamblia* and *Entamoeba hystolitica* require the use of a filter with a pore size equal to, or less than, 5 micrometres.

c. **Excessive colour, turbidity, iron or organic impurities**
Appropriate auxiliary equipment may be needed to address any of the above factors. Bacterial analyses of the treated water should be made with sufficient frequency to demonstrate the efficacy of the device in use.

(2) Excessive dissolved iron, manganese or some organics may precipitate, thereby requiring post-filtration treatment.

(3) Ozonation does not provide persistent residual bactericidal action. After a period of non-use, the system should be disinfected prior to putting it back into operation with the ozonation device.



An ozonation devices for home water treatment

6. Distillation

A. To be effective, operation should satisfy the following:

(1) The materials of construction should not react with the water to be treated, nor impart toxic constituents to the distilled water.

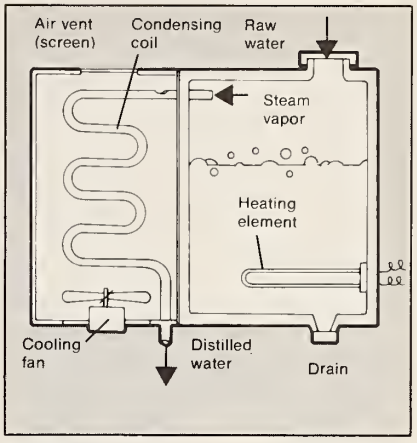
(2) The device should be constructed in such a manner as to avoid any electrical or fire hazards to the user.

B. Limitations

(1) It should be recognized that during the process of distillation any steam volatile organics in the input water (e.g. phenolics) may be carried over and concentrated in the condensate. Claims for the removal of chloroform, pesticides, herbicides or other organics should be backed by adequate test data.

(2) Microbial recontamination of the distilled water in the reservoir with undesirable micro-organisms such as *Pseudomonas* may be a problem unless the reservoir is effectively washed and cleaned regularly.

(3) Distilled water should be stored in non-metallic containers, or in receptacles specifically designed for distilled water.



A typical steam distillation unit

AESTHETIC AND CHEMICAL IMPROVEMENTS

The *Ontario Drinking Water Objectives* state: "Any water intended for human consumption should not contain any disease-causing organisms or hazardous concentrations of toxic chemicals or radioactive substances" and "...should be pleasant to drink."

A number of devices are available for removing chemicals and otherwise enhancing the quality of drinking water. Some of the disinfection devices may also be used for this purpose.

1. Activated Carbon Devices

A. To be effective, operation should satisfy the following:

(1) Activated carbon devices without concurrent disinfection should only be used on water that meets all microbiological limits as outlined in the current *Guidelines for Canadian Drinking Water Quality,* the *Ontario Drinking Water Objectives,* and the *Canadian Water Filter Industry Voluntary Guidelines for Carbon Water Filter Advertising and Promotional Claims of the Canadian Water Quality Association.*

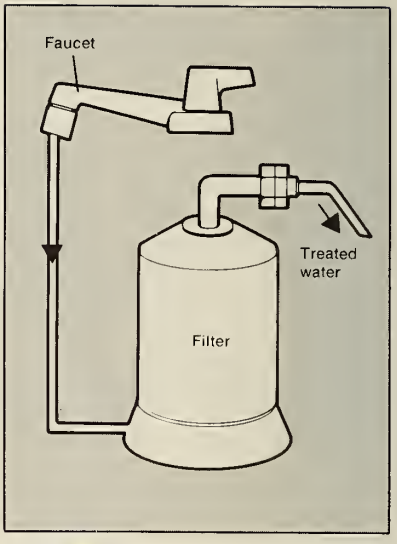
(2) These devices, when impregnated with silver, should not release silver in amounts that exceed the Guidelines and Objectives, currently 0.05mg/L.

(3) The seller should be able to provide evidence that each model/type has the potential to operate effectively over its lifetime at the maximum recommended flow rate. Appropriate data should be generated over the claimed lifetime of the device in substantiation of removal claims (e.g. evidence for the removal of chloroform, pesticides, herbicides and other chemicals should be provided).

(4) Any labelling and promotional claims made by a manufacturer should conform with the *Canadian Water Filter Industry Voluntary Guidelines for Carbon Filter Advertising and Promotional Claims:*

a. A statement should preferably be affixed to the filter itself cautioning consumers not to use the product either where the water is microbiologically unsafe or with water of unknown quality. Where labelling the filter itself is impractical, the statement should be enclosed in the filter packaging.

b. Instructions for the use of the filter should clearly emphasize the maintenance aspect of the device, such as the frequency of changing filter cartridges, and where to obtain and how to properly install replacement cartridges.



A typical counter-top activated carbon filter

B. Limitations

(1) The major drawback and concern in the use of activated carbon units is that they may support the growth of entrapped bacteria which may feed on the nutrient base of particulate matter and organic or inorganic compounds adsorbed onto the surface of the carbon filter. Bacteria, including pathogenic species, may multiply and be released into the effluent water at higher numbers than the influent water. This potential health hazard, together with the possible interference with any coliform test, limits the use of this device to microbiologically safe water only. It is recommended that the tap be flushed for at least 30 seconds after any period of non-use.

(2) If the activated carbon unit is to be used on raw water, and especially if human pathogens are known to be present, it should be used in conjunction with an appropriate point-of-use disinfection device. This device will either pretreat the water before it passes through the activated carbon filter, or post-treat the water after it has passed through it.

(3) Raw water which is excessively turbid due to the presence of suspended particulate matter may cause rapid clogging of the filter. This would necessitate its frequent cleaning and replacement, or the use of a sediment filter placed before the device to prevent deterioration in the water quality of the effluent. Certain conditions may render the use of activated carbon devices ineffective. In such cases, a combination of water treatment processes may be necessary.

(4) Chemical impurities may be released when the capacity of the carbon filter has been exceeded. This stage is very difficult to determine without extensive chemical analyses and, therefore, frequent changes of the cartridge are recommended.

2. Reverse Osmosis

Reverse osmosis (R.O.) is a water conditioning process by which water is separated from dissolved minerals or ions by the use of a semi-permeable membrane.

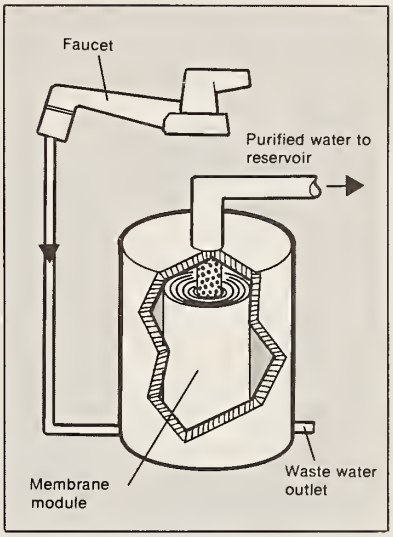
A. To be effective, operation should satisfy the following:

(1) R.O. devices should only be used on water that meets the microbiological limits as outlined in the current *Ontario Drinking Water Objectives*, the *Guidelines for Canadian Drinking Water Quality and the Canadian Water Quality Association Voluntary Standards for Point-of-use Low Pressure Reverse Osmosis Drinking Water Systems*.

(2) Evidence should be available from the seller that each model/type has the potential to operate effectively over its lifetime at the minimum recommended pressure. Appropriate data should be generated over the claimed lifetime of the device in substantiation of removal claims (e.g. evidence for the removal of inorganic and organic substances should be recorded).

(3) The labelling and promotional claims made by a manufacturer should satisfy the following guidelines:

- **a.** A statement should be affixed to, or should accompany, the R.O. device cautioning consumers not to use the product where water is microbiologically unsafe, or of unknown quality.
- **b.** Advertising claims should conform to the *'Voluntary Water Quality Industry Product Promotion Guidelines'* of the Canadian Water Quality Association.
- **c.** Instructions for the use of the R.O. device should clearly emphasize the maintenance aspects, such as the frequency of changing membranes, where to obtain them and how to install replacement membranes correctly.
- **d.** Check with the supplier for the following data:
  - (i) Product water dispensing flow rate.
  - (ii) Minimum and maximum operating pressures.
  - (iii) Minimum and maximum operating temperatures.
- **e.** All electrical components should be designed to protect the operator against electrical shock.



A reverse osmosis (R.O) water treatment device

B. Limitations

(1) With raw water, especially where human pathogens are known to be present, the R.O. device should be used in conjunction with an appropriate disinfection device at the point of use. This latter device will either pretreat the water before it passes through the R.O. unit, or post-treat the water after it has passed through the process.

(2) If the water contains high levels of iron or hydrogen sulphide, more intensive pretreatment or a combination of treatment processes may be necessary.

(3) In the absence of a booster pump, the ability of the R.O. device to separate water from the mineral impurities, or its efficiency in rejecting the mineral is greatly reduced when household drinking water line pressures are low.

(4) It should be recognized that the permeate in the reservoir should not be considered as a source of sterile water.

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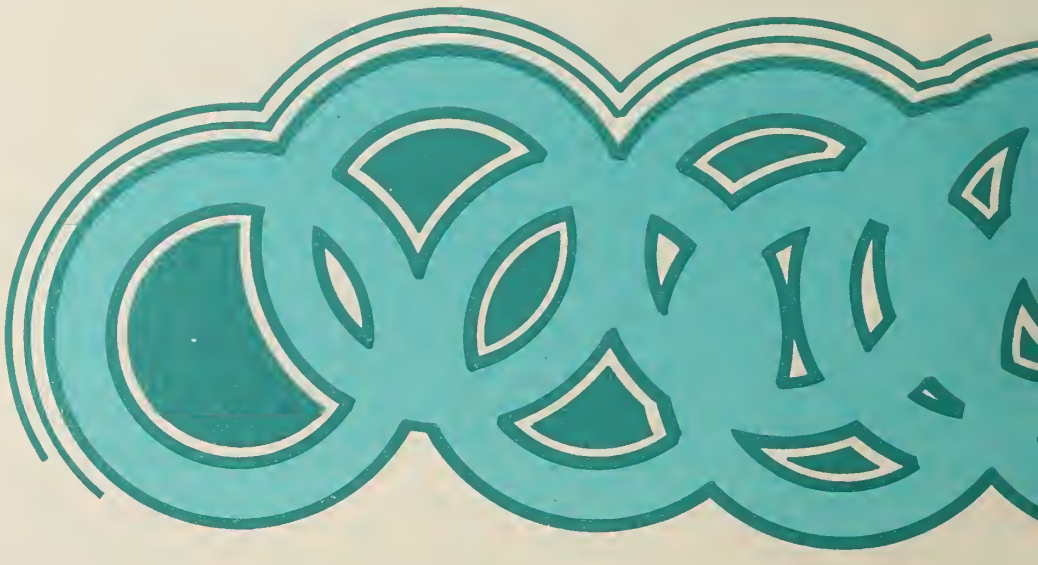
Jim Bradley, Minister



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